Claims

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method for mistake-proofing a manufacturing assembly process, comprising the steps of:

identifying high risk priority number processes from a PFMEA study;

developing a mistake-proofing strategy for product processes identified;

defining a work station configuration as to station layout, tool location, and part location;

identifying and procuring needed hardware to configure the work station;

installing and configuring hardware components and programming appropriate PLC logic for defining part and tool location;

utilizing a control plan delivery system to adapt BOM information to indicate parts used at the particular station;

assigning component parts required for a given order to the work station and defining order specific components for particular models built at the work station using current specifications;

defining individual actions to address process risks;

defining error messages to be displayed to an operator when an action fails;

establishing an affectivity date;

storing the information for hardware addresses; and,

re-utilizing and combining actions to address variations from one assembly to another.

2. A system for mistake-proofing a manufacturing assembly process, comprising:

a mainframe server containing all current product specifications including product bills of material (BOM), tooling, time standards and order configurations;

an operations data server;

a terminal for entering data via into the operations data server;

a PLC in communication with sensors provided at the workstation;

electromechanical stops linked to the PLC to prevent a part from leaving the workstation until all necessary assembly steps have been completed;

a PC physically located near the workstation, the PC in communication with the operations data server to retrieve the operation specific data relating to the specific operations for the particular workstation, the PC utilizing the information from the operations data server to retrieve source data relating to BOM, tooling, order configuration etc. from the host server, the PC having a visual display for an operator indicating BOM, assembly sequence and instructions along with visual aids if appropriate; and,

an OPC (object linking and embedding for process control) server communicating between the PC and the PLC;

whereby as the operator completes steps in the assembly process the sensors are triggered to indicate to the PLC that particular parts have been selected and particular tools have been used, parts indicators such as lights are provided in parts bins, and indicate which parts are to be selected, the PLC triggers the lights to go out once the parts have been correctly selected, when the operator concludes that all necessary assembly steps have been completed the operator sends a "next" message from the PC via the OPC server to the PLC, which returns a logic code to the PC, this logic code will indicate whether all necessary steps have been completed and if not, which steps were not completed properly, the PC then interprets the logic code and displays appropriate error messages to the operator indicating which steps were not completed properly, this allows the operator to remedy the defect, if all necessary steps were completed properly the PLC will release the electromechanical stops at to allow the part to be sent to the next workstation.

3. A method for mistake-proofing an assembly process comprising the steps of:

introducing a base part into the workstation;

identifying the base part to the system;

using the ID information to retrieve and display all assembly specific information necessary for an operator to begin working on an assembly ranked according to assembly sequence;

sending BOM part bin location information to a PLC for the specifically identified assembly;

using the PLC to activates appropriate parts bin indicators;

determining if assembly tools are interfaced to the system for the particular assembly identified and indicating such to the operator at a workstation terminal;

using the PLC to trigger appropriate ladder logic according to the assembly program for the particular assembly identified;

using the PLC to activate the proper interfaces for parts indicators, orientation, tool usage inputs, bin sensors etc. as required;

beginning work on the assembly according to the sequence displayed at the workstation terminal;

using the PLC to send a message to the system that an assembly sequence has been completed;

determining whether all ranked assembly steps have been completed;

if all ranked assembly steps have not been completed repeating the sequence for the next ranked assembly sequence; and,

sending a message to the PLC to release the assembly for position advance i.e. release electromechanical stops.

4. A process for identifying, programming, and implementing a system with appropriate mistake-proofing data comprising the steps of:

reviewing and cleaning all necessary source data;

identifying high RPN (Risk Priority Number) processes from appropriate PFMEA (Process Failure Mode and Effects Analysis) studies to be targeted for mistake proofing;

creating a map of the work content for the particular line/operation in which the process is used;

compiling a list of necessary tooling and/or gaging;

identifying affected part numbers;

identifying the production flow rate, D_c (Design for Capacity) and the model mix for the particular workstation;

correlating time study data with manufacturing engineering maps of parts bin locations;

reviewing the map and determining the overall packaging/container optimization for necessary materials;

determining appropriate part container size and/or quantity;

determining tote size, weights, quantities and locations for all necessary parts;

reviewing the proposed layout with safety and manufacturing engineering personnel;

entering the data into a part assignment interface and assigning an effective date;

identifying and purchasing the necessary hardware and configuring the equipment to interface with the mistake-proofing system;

entering the data into the part assignment PLC address interface and releasing the request for production;

monitoring the process to determine the effectiveness of the strategy and providing updates as necessary, while maintaining part location data.

5. A process for part location and indication assignment mapping for mistake-proofing an assembly process comprising the steps of:

determining whether work station benches are arranged according to a standard layout or if the layout is non-standard;

if a standard bench layout is to be used, procuring appropriate part indication light bars;

installing the light bars to the appropriate part benches and wiring them to a PLC or I/O card;

programming PLC outputs to light the appropriate part location;

storing memory address locations in a Location Data Table provided by IT

personnel;

configuring an OPC server to identify Location Data Table address locations;

using a web editing application for associating component part numbers with the Location Data Table to load station part location data; and,

providing a maintenance loop for updating the system.

6. An action group and action definition creation process, in which actions and action groups are defined and entered into a mistake-proofing system, comprising the steps of:

determining from appropriate PFMEA studies when and where mistake-proofing is required;

determining whether the required mistake-proofing strategy is new or if appropriate actions and action groups have already been defined;

if it is determined that the mistake-proofing requirements are new determining whether there are any similar existing strategies;

if the determination is that no similar mistake-proofing strategies exist creating new actions as needed in a web application wherein functions and error messages are described;

compiling the defined actions into newly created action groups;

assigning assembly numbers to the action groups;

requesting an effective date;

implementing the necessary hardware and developing PLC logic for the new actions and assigning logic addresses for the new action groups;

storing address locations in a Location Data Table;

configuring the OPC server to identify Location Data Table address locations; and,

setting an enable date.